SCIENCE

NEW SERIES
VOL. LIX, NO. 1522

FRIDAY, FEBRUARY 29, 1924

ANNUAL SUBSCRIPTION, $6.00
SINGLE COPIES, 15 CTS.

SCIENCE

VOL. LIX FEBRUARY 29, 1924 No. 1522

CONTENTS

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.

WILDIERS' BIOS[1]

WHEN it comes the turn of a professor of physical chemistry to deliver the vice-presidential address before this section, I suppose he is expected either to emphasize the value of mathematical training and urge the reading of Gibbs or to give an account of some recent experimental work in which quantitative methods played the decisive part. I have chosen the latter course as the less somniferous, although there must necessarily be a certain monotony in all such synopses: some combination of circumstances initiates the investigation; persistent hard work with an occasional happy thought carries it on; while the quantitative procedure ensures ultimate, not necessarily immediate success, for it compels "good fortune"—the discovery of essential but unexpected relations.

In the experiments on the acclimatization of yeast to ammonium fluoride carried out in Toronto by Mr. E. I. Fulmer,[2] unknown and probably variable constituents of the wort used as culture medium weighed far more than the ammonium fluoride added. The next step, obviously, was to replace the wort by a medium of known composition; but when we came to try them out, none of the sugar-salt solutions recommended in the literature gave anything like the growth of yeast obtainable with wort. Addition of a little wort improved these "artificial" media immensely—comparative experiments by Mr. F. I. Eldon showed that one fifth per cent. of wort could be detected by fermentation tube or agar plate—and after trying a couple of dozen organic nitrogen sulphur and phosphorus compounds in vain, our laboratory settled down to extract the unknown agent from the wort, while Dr. Fulmer, working independently at Iowa State College, studied media containing sugar and salts.

It did not take long to discover that the substance sought is dialysable and non-volatile; that although prolonged autoclaving of the wort is injurious, moderate heating with small amounts of acids or alkalis does no harm; that the unknown is not destroyed by addition of alcohol to the wort, and that acetone, sugar of lead, hydrogen sulphide, baryta, etc., are equally harmless, but that shaking the wort with charcoal destroys its growth-promoting power. About

[1] Address of the vice-president of Section C, American Association for the Advancement of Science, at Cincinnati, Ohio, December, 1923.

[2] *Jour. Phys. Chem.*, *26*, 455 (1922).

this time, search through the printed books led us to *La Cellule*,[3] where we read that, twenty years before, Wildiers in Louvain had passed through the same experience as ourselves, and had made far greater progress; we also found that outside the Belgian university, very little chemical work had been done on "Wildiers' bios."

In the meanwhile, Mr. N. A. Clark had been measuring the rate of reproduction of yeast suspended in wort in a "rocker-tube"—a simple piece of apparatus devised by Mr. C. G. Fraser, Jr., while studying the effect of poisons on yeast.[4] It consists of an L-shaped tube of glass closed at the lower end, immersed in the water of a thermostat, and rocked back and forward in the plane of the L. Under these conditions, continually surrounded by nutrient liquid and unaffected by the presence of its fellows, each yeast cell reproduces regularly, and the number of cells in the suspension doubles every hour and fifty-seven minutes (at 25°) from the moment of seeding until the alcohol formed by fermentation slows the rate.

As his contribution to our undertaking, Mr. Clark made similar measurements with culture fluids in which varying amounts of wort were added to a solution of sugar and salts; it was anticipated that the rate of reproduction would increase with increase in the proportion of wort, but in the event, the rate proved identical in all the media until reproduction suddenly fell off owing to exhaustion of the bios supplied with the wort.[5] These experiments led to a convenient method for the determination of bios, in arbitrary units, of course, which has proved as essential for the further progress of our work as Mr. Frazer's rocker-tube for the work of Mr. Clark.

Armed with this analytical method, which enabled yields and losses at each stage of the operations to be rapidly determined, Mr. G. H. W. Lucas proceeded with the search; but first it was necessary to secure a better source of bios than the malt infusion with its 18 per cent. of solids, largely sugars difficult to remove. As bios promotes cell division, the tips of growing rootlets seemed a likely place, and in the "combings" from the malt-house a cheap and satisfactory source was found; an infusion of these combings, with about half the bios of an equal volume of wort contains only one sixth the total solids, a good half of which can be removed by alcohol without cutting down the yeast crop in the rocker-tube. Then came a determined attempt to isolate the bios by sorption on charcoal and subsequent recovery—with puzzling results, which could not at that time be explained. Then a study of the action of barium hydrate on the alcohol-purified combings infusion; here great losses were encountered, and Mr. Lucas had every reason to sympathize with the vitamin chemists in their difficulties with the alkalis, until in the end he cleared the matter up—"bios" is not a single substance, but two; one of them carried down by baryta from solutions containing the right proportion of alcohol, the other left dissolved. Part of the baryta precipitate is soluble in water; after removing the barium this solution gives "no bios" in the rocker-tube; the filtrate from the baryta precipitate, freed from barium and tested in its turn, likewise gives "no bios"; but if both solutions together be added to the sugar-salt solution, the crop of yeast is almost as great as though a volume of combings infusion had been added equal to that from which they were prepared. The provisional name "Bios I" is proposed for the active substance carried down by baryta; it is not sorbed on charcoal, which therefore can be used to purify its solutions; neither is it removed from aqueous solution by shaking with yeast; moreover, it is not precipitated by a solution of sugar of lead, but if ammonia in excess be added to the mixture, the Bios I is carried down, and can be brought again into solution by treatment with carbonic acid. The other active substance, "Bios II," is sorbed by charcoal, and removed from solution by shaking with yeast;[6] it is soluble in acetone, and most of the impurities in its crude solution are left behind in gummy form by concentrating and extracting with that reagent.

While Mr. Lucas was engaged in attempts further to purify these two preparations (the degree of purity is measured by the quotient: yeast-crop over weight of solids in the preparation), and Mr. S. W. Robertson was working out the details of manufacture on a larger scale, Miss E. V. Eastcott undertook a survey of their distribution in the vegetable world. Some fifty grains, vegetables, fruits, plant-tissues, etc., were studied, and a few animal products; the amount of Bios I being determined by adding the vegetable infusion to the sugar-salts solution together with excess of Bios II, and *vice versa*—Mr. Clark's original method evidently gives only the amount of the constituent present in least quantity from the point of view of the yeast. In most cases, including wort itself, Bios I is present in physiological excess; *i.e.*, addition of that reagent gives no increase in the crop of yeast, while addition of Bios II adds to the yield; mushrooms, however, contain a large excess of Bios II, white of egg, malt combings, and a few others, a smaller excess. Barley grains contain an excess of Bios II, after sprouting an excess of Bios I; germination increases the amounts of both I and II,

[3] Wildiers, *La Cellule, 18,* 313 (1901); Amand, *ibid., 21,* 327 (1904); Devloo, *ibid., 23,* 361 (1906).

[4] *Jour. Phys. Chem. 25,* 4 (1921).

[5] *Jour. Phys. Chem., 26,* 42 (1922).

[6] If both I and II be present together with sugar and salts, the yeast cells bud and both are taken up.

but that of I the most. Maize unsprouted shows excess of Bios I, after sprouting more of both but still excess of Bios I, although the Bios II increases most.

Comparison of Miss Eastcott's list of plant products, etc., containing bios with those listed by Sherman and Smith as containing Vitamin B, showed that these two substances are closely associated in nature; their possible identity, debated by Williams, Backmann, Eddy and Stevenson, and many others,[7] might seem to have been decisively negatived by the alfalfa experiment of Fulmer Nelson and Sherwood,[8] but it did not seem superfluous to test the efficiency of the two new preparations. Mr. Lucas accordingly made the trial with polyneuritic pigeons in the laboratory of Professor C. C. Benson, and with rats fed on a B-free diet in that of Professor V. E. Henderson; neither Bios I, Bios II, nor both together, not even malt combings themselves cured the pigeons or caused the rats to gain in weight, while the quantity of rice polishings that contained the same amount of bios as the preparations used was immediately effective. Similar work with scorbutic guinea pigs is now in progress.

At present, Mr. H. Sims is busy making Bios I from tea dust, a material suggested by Miss Eastcott's work, particularly suitable because of its freedom from sugar; an infusion freed from tannin (and no doubt from other substances as well) by sugar of lead, and from Bios II, etc., by charcoal, is precipitated by lead acetate and ammonia and the Bios I recovered by carbonic acid. Addition of methyl alcohol to the concentrated solution throws down two inactive crystalline substances; the filtrate evaporated and heated to 105° C. leaves a colorless extremely hygroscopic residue, largely crystalline, which contains nearly all the Bios I of the original tea; some of the crystals in this product are certainly inactive, the question whether all are impurities can be answered only when our preparations for manufacture on a larger scale are complete. Mr. E. M. Sparling is engaged in purifying Bios II by sorption on charcoal and recovery by acetone or by a solution of barium hydrate.[9]

It is too soon to claim that the preparations described above are pure, so nothing useful can be told at present of their chemical reactions; however, since cheap sources have been found, and recipes that give good yields, it should not be difficult to prepare them both in quantity, and then, of course, the work of establishing their chemical relationships begins. Their "growth-promoting" power is very striking: By adding 0.1 mg Bios I and 0.3 mg Bios II to 10 cc of a solution containing sugar and 180 mg dry salts (in the proportions used by Mr. Clark) the crop after 24 hours at 25° C. is raised from 3 or 4 mg to 50 mg of moist yeast containing 6 mg nitrogen. The work of Fulmer Nelson and White[10] with synthetic media disproves the too-wide claim that bios is "indispensable au developpement de la levûre"; still, auximones exist; and the honor of their discovery rests with the professor of Louvain.

W. LASH MILLER

[7] For bibliography see *Jour. Biol. Chem.*, *46*, 77 (1921).

[8] *J. Am. Chem. Soc.*, *43*, 186, 191 (1921).

[9] February 18, 1924. Since the above was written, Mr. Sparling has succeeded in fractionating Bios II; thus Wildiers' bios consists of at least three separable constituents, all of which must be present in the medium to ensure normal reproduction of the yeast.

[10] *Jour. Biol. Chem.*, *57*, 397 (1923).

SOME FORCES IN MAN'S SOCIAL EVOLUTION[1]

I. INTRODUCTION

OUR present conception of the world and its life is of something dynamic, not static. The forces which affect the world and its inhabitants are being investigated and controlled. Diseases are no longer looked upon as arising from an offended deity. We have travelled far from the conception of the world as shown in "Oedipus," when man was utterly at the mercy of a capricious God, when nothing he willed to do could control or modify his fate. Man's knowledge of the sequence of cause and effect is being greatly broadened. The paleontologist has traced the stream of life—somewhat haltingly and interruptedly—but none the less progressively, from pre-Cambrian times through the millions of years to the present. The psychologist has not only traced our instincts, the basis of our mental life, back to their animal origins, but has indicated the way they may be sublimated and redirected to the future control of our evolution.

II. INHERITANCE

The development of the individual is dependent on the interaction of two sets of forces—the intrinsic and the extrinsic, the former represented by the possibilities resident in the individual's germ plasm, the latter by the environment into which he is born and in which he lives.

(1) INHERITANCE THROUGH THE BODY

(a) The body. Man inherits his body from prehuman ancestors. Bone for bone the plan of the skeletons of man and of all other mammals—horse, cat, dog, elephant—is identical. So, too, with all other bodily organs. More than 400 of the muscles moving man's body are present also in the cat, ending in

[1] Address of the vice-president and chairman of Section E—Geology and Geography—American Association for the Advancement of Science, delivered before the joint meeting of Section E, Cincinnati, December, 1923.

exactly the same bones, etc., and controlled by the same nerves and having similar functions. And thus it is with all the mammals. Just as similarity of word form and of construction in French, Italian and Spanish indicates a common ancestry, or the number five in the star-fish, sea-urchin, sea-lily and other classes of echinoderms shows a common ancestor, so the unity of structural plan in mammals indicates a common ancestry for them.

But man is not only related by blood to all the mammals, but more distantly to all animals with a backbone, for all—primitive fish, amphibian, reptile, bird and mammal—are built upon an exactly similar plan. All possess a backbone expanded in front into the skull through which extends the central nervous system sending off similar nerves to all parts of the body. This stiffening and supporting rod, the backbone, has attached to it two pairs of limbs with similar hipbone and shoulder supports. Still more distantly is man related to the animals without a backbone—the jointed worms, the jelly-fish and the microscopic, one-celled, protozoon amoeba. This relationship is corroborated by the individual life history of all the higher animals, including man. Each begins life as a minute protozoon-like cell, which develops into the ground plan of a jelly-fish (the gastrula), and this into an elongate form basically similar to the jointed worm. Thence the development proceeds through a form with gill-arches, etc., characteristic of the fish and thus by innumerable steps to man as he appears at birth. The brain of man shows during its development a similar relationship to lower vertebrates. In a very young embryo it basically resembles the brain of an adult fish, later of such a primitive mammal as the marsupial and still later that of such higher mammals as the lemurs.

The evidence from embryology is corroborated by the chemistry of the blood. A chemical test has long been used in law courts in murder cases. In this test the amount of precipitin formed indicates the animal whose blood is used, and the amount of precipitin formed is less and less, according to the decreasing degree of relationship. Chimpanzee blood gives 90 per cent. as much as man himself, the lower monkeys one fourth or one third as much, the lower mammals much less and thus downward in the scale. The same relationship is shown by the crystals formed from oxyhemoglobin present in arterial blood.

That this succession of animals indicates the steps in man's evolution is corroborated by the fact that these forms during earth history succeed one another in time. The protozoon, jelly-fish and worm were present upon earth during the very ancient Proterozoic time, the fish appeared first during the lower Paleozoic, the amphibian in the middle and the reptile during the upper Paleozoic. The earliest mammal made its appearance in the early Mesozoic, and man in the later Cenozoic. Evolved at various times during earth history, they persisted because of various factors of survival value which were passed on through inheritance to all succeeding generations.

(b) Impulses and instincts. Just as man has inherited his bones, muscles, nerves and other physical organs from the lower animals, so psychology shows he has with them inherited various impulses and instincts. (We are here considering these from an evolutionary point of view and have hence grouped together various instinctive reactions for simplicity of treatment.) An analysis of these forces shows that they were inherited with his body from ancestors at various periods back to the earliest protoplasm at the very beginning of earth history.

The three primary reactions—self-preservation, nutrition and reproduction—man possesses in common with all the lower animals. Without these impulses no form of life could perpetuate its kind; they must thus have been present at the appearance of life upon earth. These alone, of the impulses to be considered, were present in the protozoon, jelly-fish and worm. When the parental instinct, the next of the prominent social forces to be evolved, first made its appearance is impossible to say. It was without much doubt present in the higher fish of the middle Mesozoic and also in the reptiles and mammals of the same time, for it is present in the forms of these which have survived to the present. Many fish, such as the sunfish, are vigilant in the protection of their nests. It may have been exhibited in a rudimentary way by the fish and reptiles of the upper Paleozoic. It was naturally of great survival value to the offspring of the animals possessing it.

Later in time there developed among some mammals an association of individuals for the betterment of their protection, food-supply and care of young. Through this association into herds and packs certain modification in the behavior of the individuals must naturally take place. They would develop a susceptibility to leadership, for those failing to quickly respond would be killed off by the carnivores and thus leave no offspring. Similarly, any decided originality in conduct would be obliterated, since it would tend to expose not only the individual but the entire herd to danger. All members of the herd would thus develop the same fixed mental reactions to all ordinary happenings. Since he finds from infancy onwards both food and protection in the herd, each individual would naturally be happiest when with it; it is his normal environment.

These mental reactions would be impressed upon succeeding generations of Primate and earlier social mammals through the successful survival of the individuals exhibiting them. To-day through natural

inheritance we find them impressed upon man's body. In man we recognize the herd instinct in many characteristic reactions. Decided originality in conduct is looked upon with suspicion. What the majority say or do is right. He has fixed ideas, that is, his mental reactions are governed by what those individuals with whom he most associates, or the literature read by him, say is proper. The herd is his normal environment, that is, he is fearful of solitude, physical or mental. He is remarkably susceptible to leadership. He is subject to the passions of the pack, as is seen in mob violence or in heresy spasms. He is more sensitive to the voice of the herd than to any other influence; it can inhibit or stimulate conduct, courage, energy, endurance. This increase in energy and endurance is the basis of the cheering sections in sports. (It is a question as to how many of the various impulses grouped together under the term herd instinct are due to physical inheritance and how many are due to imitative, *i.e.*, social inheritance).

(2) INHERITANCE THROUGH THE ENVIRONMENT

(*a*) *The physical environment.* The physical environment in which organisms live has been constantly, though slowly, changing throughout the entire history of the earth. Such changes as from glacial temperatures to warm temperate, from very moist climates to arid, from land conditions to shallow ocean waters have occurred again and again. There is a progressive change in the ocean waters towards a greater density. There may be similarly a progressive change in the content of the air. But whatever present physical environment man has inherited from the past it constitutes a force with which he must reckon. Whether he lives in a region where climatic contrasts give him a high level of energy, or where the opposite is true, his habitat is a force to be considered.

(*b*) *The social environment.* In addition to the gradual expansion of consciousness through the avenues of instincts, man's prehuman forbears constantly gained a larger control over their surroundings through the increasing mass of knowledge possessed by the herd as an inheritance from the past. The lowest animals have only the knowledge (*i.e.*, ability, instinct) with which they are born. Each may add a very slight amount to his own inheritance during his life but can teach none of what he learns to his offspring. With the appearance of parental instinct, and the consequent increasing care of the young, however, there enters the imitation of parent by offspring, hence some knowledge is continued as a sort of tradition in addition to that handed down through the generations by birth inheritance. And with the coming of the herd, the young, associating intimately and long with many more than his parents, finds his imitative faculty expanded and the knowledge of his environment greatly broadened. Finally in man this knowledge is tremendously enlarged through the development of articulate speech.

The elaboration of articulate speech, which gave to man such a vast enlargement of the power of cooperation, must have progressed very slowly at first. In the later paleolithic, and especially in the neolithic stage of development writing was evolved and elaborated. At first it was confined to picture writing but was progressively simplified through the ages. It passed through the conventionalized form for more rapid use of stylus or brush to syllable writing in one direction and letter writing in another.

From now on the mass of human tradition became more full and more exact. Man's thoughts could affect others at a distance both in space and in time; hence, a tremendous impetus was given to further development. Finally, with printing, writing became cheap and thus the common heritage of all mankind. Hence more and more, the world over, men are learning to read, reaching towards the vast store of knowledge already accumulated in books, and urging themselves ever more and more rapidly to higher and higher levels. It has become a tremendous force in man's social evolution.

Earliest appearance	Inheritance through the body	Social inheritance (Through storage of knowledge from the past)					
		Printing	Writing	Elaboration of Articulate Speech	Tradition through the Herd	Tradition through Parents	Through Birth Inheritance only
Cenozoic (Late)	4. Self-consciousness and power of abstract reasoning (Man)						
Cenozoic (Early)	3. Herd Instinct (Mammals)						
Mesozoic	2. Parental Care (Higher Fish)						
Archeozoic	1. Three Primary Impulses. (All animals.) (Self-Preservation, Nutrition, Reproduction)						

III. CONTROL OF EVOLUTION

In man the control of evolution is made possible by self-consciousness and the power of abstract reasoning.

(1) Control of Evolution of Body

Very much may be accomplished in the future along this line through a broader knowledge of eugenics, and the development and spread of this knowledge should become an important force in man's social evolution.

(2) Control of Impulses by Sublimation

The instinctive reactions inherited through long ages of constant need have naturally a tremendous momentum. They become forces of great import in man's social life. The impulses of self-preservation, nutrition and reproduction, for example, that in the lower organisms are the elevating forces that pull them up against matter, become in man forces against which he must struggle. He may not destroy them, for they are essential to the life of the individual and the continuance of the human race. He must sublimate them, that is, turn their momentum into avenues socially useful. Man does not get rid of fire because it, like these lower impulses, is frequently very destructive, but controlling it turns the force into lines useful to his advancement.

The impulses of self-preservation, nutrition and reproduction, and the later evolved parental and herd instincts, inherited with our body from brute ancestors, are forces with which man must continually reckon, and which, if he is to control his social evolution, he must continually guide into socially useful channels. For example, a child should pass naturally from his intense individualism to consciousness of the rights of the herd; but if his parents, teachers and others are constantly telling him that he is different from others, bad, always doing the wrong thing, it is likely he will become an incorrigible, an individual against society because society failed to make him a part of itself at the beginning. Of the prisoners in the Charlestown (Massachusetts) prison in 1921 Dr. Stearns showed 50 per cent. were the victims of the acquisitive instinct, 25 per cent. of the pugnacious instinct, and 25 per cent. of perverted sex instinct. The acquisitive and pugnacious instincts are two phases of the impulse of self-preservation. Thus 75 per cent. of the prisoners were here because the impulse of self-preservation, which in all its aspects is perfectly right for unsocial animals, had not been acted upon by the later acquired herd instinct. The tracing back of these criminals showed that they usually started in the home as children difficult to deal with, then became incorrigible, hence were sent to delinquent schools, next to reformatories, and finally to prison. The whole life of the child was thus to represent it to itself as one apart from the herd, just the reverse of what it should have been. Such men remain, because of their education, at the mercy of their primitive impulses, unmodified even by the herd instinct, and hence become a social menace.

(3) Control of Environment

(a) Man's control of his physical environment is getting more and more complete. So large a measure of control has man established over his physical surroundings with his partial conquest of disease, a better knowledge of foods, house construction and heating that the physical is the least conditioned part of his environment.

(b) Control of social environment. Here are almost endless possibilities. It is distinctively human that it is the imponderables that form the most important groups of forces that beset man from the outer world —the ideals of the family into which he is born, the moral standards of the society in which he moves, the state of progress of the government of which he is a member—in short, the education which he receives. Though the effects of this set of forces are not inherited with the body and its accompanying instincts, yet each individual after birth becomes heir to the products of all the past evolution of his race and herein lie great possibilities. The world into which future generations are to be born can be infinitely readjusted. By virtue of being born a member of a herd, each animal is heir to a smaller or larger body of tradition, his social inheritance, built up by the accumulated experience of the herd. By virtue of being born a man, he is self-conscious and hence need not, like the animals below him, be wholly at the mercy of the inherited instincts and the inherited body of social experience. On the one hand, he may control or sublimate the instincts; on the other, he may add his own experience to that he inherits from his herd and may hence consciously shape to some degree the body of social experience, that is, the social inheritance which is handed on to the next generation.

IV. Summary and Philosophic Deductions

The flow of evolving energy from early pre-Cambrian times to the present expresses itself through ever more complex forms until individualization is attained in man with consciousness of self. This energy expresses itself through each individual organism in the process of living. But certain acts involved in this process of living are performed so frequently and are so essential to the life of the race that they have become impressed upon the nerve cells as natural impulses and instincts. Three of these impulses, which have characterized life ever since its inception upon earth many millions of years ago, are self-preservation, nutrition and reproduction. Without these life could not have persisted. Later, during the Mesozoic arose the parental instinct, and still later

during the early Cenozoic the herd instinct. As soon as an animal becomes a social organism all its acts, even such individualistic primitive impulses as self-preservation and nutrition, become social forces. For as soon as individuals unite into a group the acts of each affect all. A man may drink alcohol as an individual act, but in his family or when handling an automobile the social aspects of this act are seen.

Man is thus permeated with tendencies toward a definite expression of his energies, that is, impulses and instincts inherited from his brute forbears; but in addition he bears within himself powers, attained with his manhood, capable of controlling and guiding their expression. Below man life is very largely at the mercy of its impulses, but with the incoming of self-consciousness and the power of abstract reasoning man can scrutinize these impulses and decide how to modify their expression. He may not destroy these impulses which he has inherited with his body, for they are essential to his individual life and the continuance of the race. He must turn them into avenues socially useful, or the human race will cease to advance and finally to exist.

The entire behavior of each invertebrate animal and of many of the lower vertebrates is governed by the three primary impulses alone—self-preservation, nutrition and reproduction. When parental instinct appears it becomes, in its best expression, dominant. When in the cat, for example, the offspring are small, the mother will forego her own preservation or nutrition for the sake of her young. Again, when the herd instinct appears, it takes precedence over the others. In wild cattle the preservation of the herd is more important than the preservation of one adult or one young.

The next step is naturally that man with his higher attributes of self-consciousness and his power of abstract reasoning is gradually realizing the oneness of the human race, the brotherhood of man, as well as his kinship with and hence responsibility to the lower forms of life.

With the ability to stand off and view himself attained with the incoming of self-consciousness man apparently again passed through the earlier stages of social evolution. In very primitive man the family is the highest unit; next the tribe takes precedence, then the nation, and to-day the internation is being emphasized. Throughout earth history the movement has been from the care of the individual to the care of an increasingly larger group. In the recent past we note among mankind this enlarging conception of brotherhood in the freedom of slaves, the care of the deformed and crippled, the growing equality of opportunity for the sexes, recognition of insanity and crime as disease and a growth in religious tolerance. Once before, during Roman times, this truth of man's brotherhood was emphasized by the early Christian Church; but the lack of close intercommunication so necessary for any feeling of unity was a fatal obstacle. With worldwide commerce, wireless telegraphy, cheap printing and a growing ability by all peoples to read, it appears that to-day is the time for the next upward step, making of all people one great unity. This enlarging conception of brotherhood is, as we have seen, a force established with the initiation of life upon earth. It has not varied throughout the subsequent millions of years, and is thus a force with which man must reckon if he would continue to live upon earth.

In the very impulses which he inherits from his brute ancestors man possesses forces which he can control for the advancement of the race. For example, because of this inheritance man views with suspicion pronounced originality of conduct. What the majority say or do is considered right, not because each has reasoned it out for himself, but because the fear of originality of conduct is impressed into the very nerve cells of man's body through long ages of inheritance because of constant need. This is not only a tremendous factor in the stability of any social structure, such a society and government, but we recognize that changes may be brought about only slowly and by process of education. The essence of education is self-discovery and self-control. The education of the future should give not only the facts of man's inheritance but the knowledge of them as forces which can be controlled, and the profound conviction that the world must be made a better environment for future generations to be born into, and that each individual can thus modify it to some degree.

Hervey W. Shimer

Massachusetts Institute of Technology

THE AMERICAN MUSEUM OF NATURAL HISTORY

The Fifty-fifth Annual Meeting of the Board of Trustees of The American Museum of Natural History was held at the residence of the president, Henry Fairfield Osborn, on the evening of February 4. The following changes took place in the Board of Trustees:

Mr. George F. Baker succeeded Mr. Cleveland H. Dodge as first vice-president, Mr. Dodge having served thirteen years in this office. Mr. Dodge continues his membership on the board which began in February, 1904. Mr. J. P. Morgan was reelected second vice-president for the twelfth year; Professor Henry Fairfield Osborn reelected to the presidency for the sixteenth year; Mr. Percy R. Pyne was reelected secretary for the fourth year.

The late Mr. Thomas DeWitt Cuyler is succeeded

by Mr. Roswell Miller, a graduate of Princeton, an engineer by training, son of the late Roswell Miller, of the Chicago, Milwaukee & St. Paul Railway. Mr. Arthur Curtiss James is succeeded by Mr. Clarence L. Hay, son of John Hay, a graduate of Harvard and specialist in Mexican and Central American archeology.

COMMITTEES OF THE TRUSTEES

The names of Mr. George D. Pratt and Mr. Cleveland Earl Dodge were added to the executive committee.

Mr. George F. Baker, Jr., was reelected treasurer and chairman of the Finance Committee for the fourth year. He has associated with him on this committee Mr. Felix M. Warburg, of Kuhn, Loeb and Company; Mr. Walter Douglas, of Phelps Dodge and Company; Mr. A. Perry Osborn, of Redmond and Company; also the first vice-president, Mr. George F. Baker. Reappointed to the advisory committee on finance are Mr. Charles E. Mitchell, of the National City Bank; Mr. F. D. Bartow, of the First National Bank, and Mr. Arthur M. Anderson, of J. P. Morgan and Company. The income from the General Endowment Fund has increased \$5,000 during the present year through judicious investment by the finance committee.

SCIENTIFIC STAFF

On the scientific staff, Director Frederic A. Lucas, after twelve years' service, retires as active director and becomes honorary director, and acts in an advisory capacity in all the exhibition halls. Mr. George H. Sherwood is promoted to the post of acting director for the period of two years.

MAINTENANCE AND OPERATING EXPENSES

The city administration, appreciating the service that the museum is rendering to the public, and especially its relations to the public school system, provided an appropriation of \$342,313.36, which has been applied to the care and upkeep of the building and the maintenance of its educational activities. In the same liberal spirit, the city also appropriated \$184,950 for necessary repairs, construction and equipment in the existing building, as well as an additional appropriation of \$163,800 for the School Service Building now ready for construction.

The year 1923 opened with an advance contribution of \$38,000 by the trustees to meet a prospective deficit of \$40,000 in maintenance and operating expenses. Thus the year 1923, through various economies, closed without a deficiency, the total budget expenditure being \$967,053.33.

To the minimum budget of 1924 the trustees have guaranteed \$55,404.70 to cover the deficiency in a budget of \$963,928. This method of meeting the annual budget deficiency by raising it in advance was instituted by Mr. J. Pierpont Morgan ten years ago. It brings about economies which result in closing the year with all bills paid.

GENERAL ENDOWMENT

The present total endowment of \$11,591,617.22 includes a number of generous recent contributions, as follows: Mr. George F. Baker, \$250,000; Mr. Edward S. Harkness, \$100,000; Mr. John D. Rockefeller, Jr., \$1,025,000; Mr. J. P. Morgan, \$127,187.50; Mr. George D. Pratt, \$50,000; Mr. Arthur Curtiss James, \$26,750; Mr. Felix M. Warburg, \$19,000. This endowment is still inadequate to the amount of \$3,000,000 to meet the regular educational, exhibitional and operating expenses of the museum, which have increased 250 per cent. during the fifteen year period, chiefly owing to doubling and trebling of living costs, wages and salaries in the City of New York, which is now probably the most expensive city in the world.

It is estimated by President Osborn that an endowment of \$15,000,000 will be needed to operate the museum when the three new buildings—the Asiatic Hall, the Oceanic Hall and the School Service Building, now under construction by the city at a total cost of \$3,000,000—are completed.

Highly as the president and trustees value the popular and financial appreciation of the museum, they realize that the museum is very far from being complete at present, that very extensive rearrangement of the collections must be made to bring about an ideal educational arrangement, that we must look forward finally to a permanent endowment fund of not less than \$20,000,000, and so equivalent to that of the present endowment of the New York Public Library, in order to care for future increases in public and popular attendance and in the serious educational and scientific work in the schools, colleges and universities of this country.

TOTAL GIFTS TO MUSEUM DURING THE PAST FIFTEEN YEARS

In order to show how gifts and appropriations of the past fifteen years have kept pace with the increasing public service by the museum and increasing cost of operation, the president gave a summary of the financial administrative and educational development of the museum during this time, leaving the scientific summary of this series of years for the printed report which will appear on May first. The total gifts to the museum during this period have been as follows: From the City of New York, in building and equipment (including the School Service Building to be erected at a cost of \$733,800), \$3,050,525.54. The

total contributions of members of the board of trustees, under special funds and gifts, amount to $2,895,241.82. The total gifts of members and friends other than trustees during the same period amount to $8,260,476.23. Thus, during the past fifteen years, the grand total of additions to permanent equipment, to building, to exhibition and to the endowment of the museum is $14,206,243.59, an average of a little less than $1,000,000 a year.

INCREASE IN MUSEUM COLLECTIONS DURING 1923

The year 1923 has been exceptional in the rapid increase of collections from all parts of the world. Either an emergency gift of $300,000 for preparation and exhibition or the annual interest on a new endowment fund of $3,000,000 is needed to keep up with this astonishing growth through the museum's expeditions and through the liberality of the city in the erection of new buildings.

First in order of importance, during the year 1923, is the Faunthorpe-Vernay collection from India, including gifts by the Maharajahs of Nepal and Mysore and the Viceroy of India—a superb collection of mammals and birds valued at not less than $100,000. The gifts of trustees and friends of the museum and the Asiatic Society to the third Asiatic expedition total $43,432 for the year, resulting in the great discoveries in Mongolia and in superb collections from China and Mongolia. The museum is also indebted to Mrs. Henry Clay Frick for the gift of a unique collection of fossils from the Siwalik Hills of India and from Burma, of a total value of $15,000. To this Mr. Childs Frick has added during the year $16,300, making a total contribution of $31,250 towards collections, chiefly of Pliocene age, from California and other western states. Mr. Harry Payne Whitney has continued for the third year his annual gift of $20,000 towards a total of $100,000 to secure a representative collection of the birds of the oceanic islands of Polynesia. An indirect gift for the support of the Martin Johnson Second African Expedition by the Martin Johnson African Expedition Corporation, for five years, constitutes an annual expenditure of $100,000.

SCHOOL SERVICE AND ATTENDANCE DURING FIFTEEN YEARS

The corresponding growth of public interest in the museum during the fifteen year period is shown by the increase in attendance from 537,984 in 1907 to 1,440,726 in 1923, an increase of more than 167 per cent. The school service attendance in the museum, included in the above figures, increased from 30,000 in 1907 to 123,756 in 1923, while the total number reached by the museum's extension service to the schools has increased from 778,510 in 1907 to 5,630,811 in 1923, an increase of 623 per cent. The annual membership income has arisen from $15,300 in 1907 to $38,395 in 1923, and the total membership is now 7,350.

SIX NEW EXHIBITION HALLS

An emergency subscription of $300,000 for preparation and exhibition is needed now because the minimum budget of 1924 does not provide for the very important emergency requirement of filling the six new exhibition halls now being constructed by the city, with their respective exhibitions from various parts of the world, namely, the Oceanic Hall, the Gallery of the Oceanic Hall devoted to the smaller marine life, the Hall of Fishes devoted to the fishes of the world, the Asiatic Hall devoted to the splendid new Asiatic collections presented through Colonel J. C. Faunthorpe and Mr. Arthur Vernay, as well as the rich collections of the third Asiatic expedition, the Hall of Amphibians and Reptiles occupying the third floor, the Hall of Giant Ceratopsians occupying the fourth floor.

These six new exhibition halls now being added to the museum by the taxpayers of the city have been constructed at a cost of $1,500,000 after plans gradually maturing since the year 1911, when the present arrangement was decided upon, and promise to be at once the most beautiful and the most impressive museum exhibition halls in the world. They embody all the latest ideas and ideals of museum construction and are receiving the scientific supervision of leading experts like Honorary Director Lucas, Assistant Director James Clark, in charge of preparation; the noted animal sculptor, Carl E. Akeley; the ichthyologist, Bashford Dean (also on the Metropolitan Museum Staff); Roy C. Andrews, explorer and mammalogist; Roy W. Miner, specialist in invertebrate zoology; the herpetologist, G. Kingsley Noble, graduate of Harvard, and the paleontologists, Henry Fairfield Osborn and William D. Matthew.

MARY A. DAY

MISS MARY ANNA DAY, for thirty-one years librarian at the Gray Herbarium of Harvard University, died in Cambridge, Mass., on January 27, 1924, in her seventy-second year. She was born in Nelson, N. H., on October 12, 1852. Educated in the Academy of Lancaster, Mass., she was from 1871 to 1880 a teacher in the Massachusetts public schools. Later she became librarian in the Public Library of Clinton, Mass. She accepted appointment at the Gray Herbarium January 1, 1893, succeeding as librarian of that establishment Miss Josephine A. Clark, who had been called in similar capacity to the United States Department of Agriculture at Washington.

Without previous training in botany, but with exceptional ability and great industry, Miss Day rapidly perfected herself in the technical details of her work, becoming within a few years a person of recognized skill in all matters relating to botanical bibliography. Precise and methodical in all her records, a critical reader of difficult proof, and familiar in extraordinary degree with botanical literature, she rendered invaluable aid to many writers dealing with the classification of plants. She assisted in seeing through press the posthumous portions of Dr. Asa Gray's "Synoptical Flora of North America," the seventh edition of Gray's "Manual of Botany," and most of the contributions from the Gray Herbarium which have appeared during the last three decades. For about twenty years she edited, and herself largely compiled, the *Card Index of New Genera and Species of American Plants*, a quarterly publication of importance in American botany. This was an undertaking of no small magnitude. It involved the indexing, page by page, of upward of 130 scientific serials from all parts of the world, and of numerous monographs in a great variety of languages. Last November, when failing health obliged her to give up further work, this index contained about 170,000 cards. It is in constant use at the larger botanical establishments throughout the country, and Miss Day had the gratification of receiving many appreciative comments upon its accuracy and reference value.

In the early years of the New England Botanical Club, she prepared and published for that organization a "List of local floras of New England," and a similar paper on the "Herbariums of New England," both of them exceedingly helpful to the work of the club. She became a widely known expert in her field and from all parts of the country, and even from foreign lands, her judgment was solicited on difficult points relating to the literature of botany—exact dates of publication, ambiguous citations, obscure editions, valuation of rare works, etc. Generous with her time and aid she won the gratitude and high regard of scores of investigators in the science of botany, and will be greatly missed from the post she has long held with distinguished ability.

B. L. Robinson

Gray Herbarium

SCIENTIFIC EVENTS

THE INTERNATIONAL CONFERENCE ON APPLIED MECHANICS IN HOLLAND

The undersigned have organized an international conference on Applied Mechanics (embracing rational mechanics, the theory of elasticity and hydro- and aerodynamics) at Delft (Holland), seat of the Dutch Technical High School.

During the past years in all countries many important results have been obtained in these branches of science; owing to the political circumstances, however, the exchange of ideas and the mutual contact have remained less than desirable. For these reasons the first four signers have considered the possibility of convoking a general meeting, so much the more as they were aware of the success of a conference of scientists of various countries which gathered at Innsbruck (Tirol) in September 1922 to discuss questions of hydrodynamics and aerodynamics. They directed themselves to a number of scientists who are working on the domain of applied mechanics, in order to demand them to support their project, and to their great pleasure they received an affirmative answer of the greater part of these scientists, whose names are mentioned in the list below.

In view of this the success of an international conference could be considered to be certain, and so it has definitively been fixed that a meeting will be organized from April 22 to April 26, 1924. Of these days two will be appointed for general sessions, and two for separate sessions of the three sections for:

Rational mechanics;
The theory of elasticity;
Hydro- and aerodynamics (including aeronautics).

In accordance with the purpose of the conference it has been planned for the general meetings to make provision for summarizing reviews of those questions, in which great successes have been obtained during the last years, *e.g.*:

Graphical and numerical methods of solving differential equations;
Experimental methods of solving stress problems;
Stress problems in plastic media;
The theory of rupture;
The physical aspects of non elastic deformations;
Friction and lubrication;
Motions in rotating fluids;
Stability of fluid motions;
Wave motion;
The motion of a fluid in the boundary layer along the surface of solids;
The turbulence in the oceans and in the atmosphere;
The dynamics of the atmosphere.

Professor C. B. Biezeno, Delft,
Professor J. M. Burgers, Delft,
Professor J. A. Schouten, Delft,
Dr. E. B. Wolff, Amsterdam,
Executive Committee
Professor J. S. Ames, Baltimore,
Professor L. Bairstow, London,
Professor V. Bjerknes, Bergen,
Profesor E. G. Coker, London,
Professor Ph. Forchheimer, Wien,

DR. A. A. GRIFFITH, Farnborough,
PROFESSOR TH. VON KARMAN, Aachen,
PROFESSOR T. LEVI-CIVITA, Rome,
PROFESSOR R. VON MISES, Berlin,
PROFESSOR C. W. OSEEN, Upsala,
PROFESSOR TH. PÖSCHL, Prag,
PROFESSOR L. PRANDTL, Göttingen,
MR. R. V. SOUTHWELL, Teddington,
PROFESSOR A. STODOLA, Zürich,
DR. G. I. TAYLOR, Cambridge.

RUSSIAN BIOLOGICAL INSTITUTIONS

APROPOS of the list of then-existing biological institutes compiled by H. J. Muller during a trip to Moscow and Petrograd in August, 1922, the following information received from Dr. W. Grossmann, of the Permanent Bureau of the All-Russian Entomo-Phytopathological Congress, Petrograd, may add to our meager knowledge as to the now-existing natural history societies in Russia. In reply to a letter containing a list of Russian corresponding societies of the Academy of Natural Sciences of Philadelphia, Dr. Grossmann wrote, under date of December 24, 1922, that the societies and institutions listed below exist "up to the present time," and states that "their names are the same" only the word "Imperial" must be omitted where formerly used.

Moscow. Société des Amis d'Histoire Naturelle.
" Moskovskoe Obstchestvo Estestvo-Ispytateley.
Petrograd. Russian Academy of Sciences.
" Botanitcheski Ssad.
" Comité Géologique.
" Musée Géologique de l'Université.
" Russkoe entomologitscheskoe Obstchestvo.
" Société Russe de Géographie.
" Mineralogitcheskoe Obstchestvo.
" Tsentralnaia Fizitcheskaia Observatoria.
" University.
Tiflis. Botanical Gardens.
" Musée du Caucase.

Dr. Grossmann regrets his inability to send some Russian publications on entomology, "as our formalities of censorship are very complicated and postal charges very high." I am sure we all agree with Dr. Grossmann's concluding paragraph, "Let us hope that in some not too distant future the circumstances will change for the better."

WM. J. FOX
THE ACADEMY OF NATURAL SCIENCES
OF PHILADELPHIA

DATA FOR CRITICAL TABLES

THE Editorial Board of International Critical Tables will appreciate receiving from scientific investigators any numerical data which they are able and willing to furnish, which have not been published prior to January 1, 1924. All data are desired which characterize the behavior of any definite material (*e.g.*, natural or industrial materials), substance, or system. For the purpose of this request, such data will be divided into two classes, as follows: Class I: data which constitute the only information of the kind available; Class II: data which, in the opinion of the investigator, substantiate, extend or improve existing information of the same kind.

In connection with data belonging to both classes, the following information should be given: (a) An exact definition of the material, substance, or system to which the data apply, (b) the investigator's estimate of the accuracy of the values, (c) the name of the investigator or investigators responsible for the measurements, (d) the laboratory in which the investigations were carried out, (e) a brief statement of the experimental method used, (f) an exact statement of the units in which the data are expressed, and (g) any other supplementary information necessary for the complete characterization of the data.

For data belonging to class II, such additional details should be furnished as will enable our expert in charge of this class of data to critically evaluate the new data in comparison with the older data.

Any data belonging to class I, received prior to January 1, 1925, and any data belonging to class II, received before July 1, 1924, will be in time for inclusion in the International Critical Tables, and the source of all data so included will be indicated by "Private Communication from, etc.," unless a literature reference becomes available prior to going to press.

LECTURES GIVEN UNDER THE AUSPICES OF THE AMERICAN CHEMICAL SOCIETY

FOLLOWING the policy of the U. S. Military and Naval Academies to invite members of the American Chemical Society to address their classes, the schedule of lectures for the present year has been announced as follows:

MILITARY ACADEMY

April 9. Chas. H. Herty, president, Synthetic Organic Chemical Manufacturers' Association, New York, N. Y., "Organic chemistry in national defense."

April 16. S. C. Lind, chief chemist, Bureau of Mines, Washington, D. C., "Gases in aeronautics."

April 23. General A. A. Fries, chief, Chemical Warfare Service, Washington, D. C., "Chemical warfare."

April 30. H. E. Howe, editor, *Industrial and Engineering Chemistry*, Washington, D. C., "Chemistry in world affairs."

May 7. Charles E. Munroe, National Research Council, Washington, D. C., "The development of explosives."

NAVAL ACADEMY

January 5. E. E. Slosson, *Science Service*, Washington,

D. C., "The economic independence of the United States."

Washington, D. C., "Optical glass in warfare."

Washington, D. C., "Optical glass in warfare."

February 9. F. N. Speller, National Tube Co., Pittsburgh, Pa., "Corrosion of metals."

March 15. Charles E. Munroe, National Research Council, Washington, D. C., "The lessons on explosives taught by the war."

April 12. C. F. Burgess, Burgess Laboratories, Madison, Wis., "The dry battery."

THE MOORE SCHOOL OF ELECTRICAL ENGINEERING

More than 1,000 engineers, together with many alumni and friends of the University of Pennsylvania, participated in the formal opening of the Moore School of Electrical Engineering on February 6. The event was made a part of the program of the American Institute of Electrical Engineers, which was holding its fortieth annual convention in Philadelphia.

In honor of the event the university bestowed the honorary degree of Doctor of Laws upon four of America's most distinguished electrical engineers and the degree of Doctor of Science upon two members of the engineering faculty. For this purpose there was a special convocation in Weightman Hall. Those who received the degree of Doctor of Laws were Elihu Thomson, famous consulting engineer with the General Electric Company and a pioneer in the development of various electrical apparatus; Edward Weston, president of the Weston Electrical Instrument Company; Frank Julian Sprague, inventor of the multiple unit system of electrical train control, and John J. Carty, vice-president of the American Telephone & Telegraph Company. Those who received the degree of Doctor of Science were Dean Harold Pender, of the Moore School of Electrical Engineering, and Dr. Robert J. Fernald, professor of mechanical engineering.

Dr. Josiah H. Penniman presided at the exercises in Weightman Hall. The two speakers were Herbert Thacker Herr, vice-president of the Westinghouse Electric Company, and Dr. Arthur M. Greene, Jr., dean of the school of electrical engineering at Princeton.

Dr. Penniman first introduced George Stevenson, a lifelong friend of Mr. Moore, and one of the trustees of the Moore School as provided in his will, who presented to the university a portrait of Mr. Moore in behalf of Mr. and Mrs. William Verner. Said Dr. Penniman:

This is an important day in the history of education in America. The dream of a distinguished citizen of Philadelphia is now a reality. The late Alfred Fitler Moore made provision in his will for the founding of a School of Electrical Engineering to be located in Philadelphia, and to bear the name of the Moore School of Electrical Engineering, in memory of his parents. The trustees of the estate, in order to carry out in worthy manner the will of Mr. Moore, invoked the Orphans' Court for approval of a plan whereby the existing course in Electrical Engineering at the University of Pennsylvania might, with the concurrence of the trustees of the university, become the Moore School. The Court approved the plan as presented, after agreement to the terms of it by the trustees of the estate and the trustees of the university, who were thereby appointed the Board of Managers of the school. Upwards of a million and a half dollars became immediately available for the purposes of the new school. Owing to the existence in the engineering building of the university of suitable space and equipment for the present needs of the school, it is unnecessary to expend a part of the principal for a building. The income from the fund will alone be needed at present. The director of the course in electrical engineering, Dr. Harold Pender, has been appointed the first dean of the Moore School, and to-day we hold formal exercises in commemoration of this notable addition to the technical schools of America.

SCIENTIFIC NOTES AND NEWS

The Bessemer Gold Medal for 1924 has been awarded by the Iron and Steel Institute of Great Britain to Albert Sauveur, professor of metallurgy and metallography at Harvard University, "in recognition of eminent services in the advancement of the science of the metallurgy of iron and steel." The medal will be presented to Professor Sauveur at the May meeting of the Institute in London. This is the sixth time that the Bessemer Medal, founded in 1874, has been awarded to an American metallurgist, the last award having been made to Henry Marion Howe twenty-nine years ago. The other American recipients have been: Peter Cooper (1879), Alexander Lyman Holley (1882), Abram S. Hewitt (1890) and John Fritz (1893).

Statues of Dr. Edgar Fahs Smith, provost of the University of Pennsylvania from 1911 to 1920, and of Charles Custis Harrison, provost from 1895 to 1910, will be erected on the university campus. The statues have been given by Mr. John C. Bell, a member of the Board of Trustees.

Dr. Charles W. Eliot, Dr. W. W. Keen and Dr. Benjamin White were elected to honorary fellowship at the meeting of the Massachusetts Medical Society on February 6.

The recent publication of the twenty-fifth anniversary volume of the *Revista Chilena de Historia Natural* has been the occasion of the conferring of several scientific and academic honors upon its editor, Dr. Carlos E. Porter, who is professor of zoology, en-

tomology and microscopy in the Instituto Agronomica de Chile, professor of parasitology in the Escuela Nacional de Medicina Veterinaria, and also curator of invertebrates in the Museo Nacional de Santiago. The Association française pour l'avancemen des Sciences conferred upon him its silver medal; the University of Cuzco has conferred upon him the title of honorary member of the Faculty of Physical and Natural Sciences in that university; the Agronomical Society of Chile has conferred upon him its gold medal extraordinary; the Société Scientifique de Chile has made him an honorary member and the Chilean Government has doubled the financial support which it has heretofore been according the *Revista*.

H. V. Arny, professor of chemistry in the College of Pharmacy of Columbia University, was the guest of honor at a dinner tendered him by thirty of his friends at the Hotel Pennsylvania, New York, on the evening of January 14. The dinner was arranged to celebrate Dr. Arny's election to the presidency of the American Pharmaceutical Association. He was presented with a gold watch and an engrossed book including the signatures of the participants.

General Gustave Ferrié, head of the French government wireless services, has been awarded the Kuhlmann foundation gold medal given annually in France through the intermediary of the Société Industrielle du Nord. General Ferrié has been identified with wireless telegraphy since 1899 and has written on radio telegraphy and kindred subjects.

Professor Alois F. Kovaric, of Yale University, has been elected an Honorary Member of the Society of Czechoslovak Mathematicians and Physicists.

Dr. R. D. Landrum was elected president of the American Ceramic Society, at the meeting held early in February in Atlantic City.

Professor A. E. Kennelly, of Harvard University and the Massachusetts Institute of Technology, was chosen chairman, and Professor John Frazer, of the Towne Scientific School of the University of Pennsylvania, secretary of the committee of American universities in the exchange with France of professors of engineering and applied science at a meeting held at the University of Michigan, on January 26.

Professor Jacob G. Lipman, of the State University of New Jersey, has been appointed a member of the International Commission of Agricultural Ecology.

Dr. Arthur Smith Woodward will retire in May next from the keepership of geology in the British Museum which he has held since 1901.

E. Ballard has resigned his post as lecturer in entomology in the University of Bristol, on his appointment as entomologist to the Empire Cotton Growing Association in Queensland.

Dr. Otto R. Eichel, of Albany, for the last seven years director of vital statistics of the New York State Department of Health, has been appointed to direct the section of epidemiological intelligence and statistics of the League of Nations. One of the chief functions of Dr. Eichel's work at Geneva will be to build up a system of international exchange of reports on epidemic diseases, with emphasis on their prevalence and mortality.

Dr. William J. Crozier, professor of zoology in the State University of New Jersey, has been appointed associate of the Carnegie Institution. This appointment carries with it financial support adequate to pay the greater part of Dr. Crozier's salary, to provide an assistant for him, and to buy certain pieces of apparatus. The college on its part provides laboratory space for the work, a part of the equipment and the remainder of the associate's salary. Dr. Crozier retains his position as head of the department of zoology, and continues to give one course to undergraduates.

Dr. A. V. H. Mory, formerly director of research at the Procter and Gamble Company, Cincinnati, has been appointed director of scientific publicity for the Bakelite Corporation.

Professor Joseph T. Singewald, Jr., of the Johns Hopkins University, and Lincoln Ellsworth sailed on February 21 for Peru, to make a geological cross section of the Andes Mountains. It is planned to spend seven months in South America.

Theodore R. Gardner and Harold A. Jaynes, of the Bureau of Entomology, United States Department of Agriculture, sail on March 4 from San Francisco for Kobé, Japan, to carry on research work in parasitology, with special reference to the Japanese beetle (*Popillia japonica* New.). After a year in Japan and Korea, they expect to continue for several years the study of allied parasites in China and India.

Parker H. Daggett, professor of electrical engineering at the University of North Carolina, is spending his sabbatical year at Milton, Mass., where he is writing a treatise on electrical engineering.

On January 30, Professor M. F. Guyer, of the University of Wisconsin, addressed the Sigma Xi Club of the University of Arizona on the subject of "Production of inheritable eye defects in rabbits."

Dr. Ludwig Aschoff, professor of pathology of the University of Freiberg, Germany, has accepted

the invitation of Stanford University to deliver the Lane Medical Lectures for the year 1924. The probable date of the lectures will be from May 26 to 30, inclusive, in Lane Hall of the Stanford Univeristy Medical School, San Francisco. The subjects of the lectures will be: The place of origin of the biliary pigment; atherosclerosis; ovulation and menstruation; inflammation; fatty changes in disease.

THREE lectures were given at the London School of Economics on February 22, 26 and 29, by Professor A. P. Brigham, of Colgate University, the subject being "The United States, Regional and National."

PROFESSOR DOUGLAS JOHNSON, of Columbia University, who is exchange professor to France in engineering and applied science for 1923–24, gave recently in Nancy public lectures on "The Grand Canyon of the Colorado," and on "The formation of the glaciers of the west."

THE Hugo Müller lecture of the Chemical Society was delivered by Professor J. Joly on February 28, in the lecture hall of the Institution of Mechanical Engineers.

DR. JOHN M. T. FINNEY, professor of clinical surgery at The Johns Hopkins University, delivered the Hodgen Memorial Lecture at the Bartscher Auditorium of the St. Louis Medical Society on February 28.

THE EDWARD G. JANEWAY Lectures of Mount Sinai Hospital, New York, for 1924, will be delivered in April by Professor Ludwig Aschoff, professor of pathology and anatomy at the University of Freiberg.

PROFESSOR ALBERT SAUVEUR, professor of metallurgy and metallography in Harvard University, delivered on February 19 in New York the first Henry Marion Howe Lecture, on the foundation recently established by the American Institute of Mining and Metallurgical Engineers.

THE Royal Anthropological Institute has founded a Rivers memorial medal, in memory of Dr. W. H. R. Rivers, who was president of the institute at the time of his death. The medal will be awarded for special meritorious anthropological work in the field. All British subjects and anthropologists of other nations who are fellows of the institute will be eligible.

G. H. QUINCKE, from 1875 until 1907 professor of physics in the University of Heidelberg, has died aged eighty-nine years.

PROFESSOR C. K. CLARKE, since 1907 professor of psychiatry and dean of the medical faculty from 1907 until 1920 in the University of Toronto, has died at the age of sixty-nine years.

THE *Journal* of the American Mathematical Association writes: "On the two hundredth anniversary of the birth of Euler, a committee of the Society of Swiss Naturalists launched the project of international cooperation for the publication of his collected works. Academies, societies, including the American Mathematical Society, and individuals subscribed for about 300 sets. Eighteen of the estimated seventy volumes have been published. By reason of the European war nearly one half the subscribers have been unable to meet their obligations in full. Under these circumstances, a considerable number of new subscribers must be secured if the completion of the undertaking is to be possible in the near future. Those libraries or individuals wishing information with a view to promoting this great international undertaking should communicate with Professor R. C. Archibald, Brown University, Providence, R. I."

THE sixty-seventh meeting of the American Chemical Society will be held at Washington, D. C., April 21 to 26, 1924. Unusual opportunities will be afforded the members of the society to see the various government laboratories in operation during that week and elaborate preparations are being made to that end.

THE jubilee of the Physical Society of London will be celebrated on March 20 to 22. Among the arrangements are a reception, a dinner, the Guthrie lecture and the recounting of reminiscences by original fellows and other fellows of long standing, including, it is hoped, Professor J. A. Fleming, who read a paper at the first meeting, and Sir Oliver Lodge.

AT a recent meeting in Paris of scientific men, deans of the faculties, directors of large scientific institutions, and others, M. Léon Bérard, French minister of public instruction, discussed the national subscription for research laboratories. He said that it was not the province of the central government to interfere in the distribution of funds collected for laboratories, which amount now to about 13,000,000 francs. The task must be left to the committee of scientific men who know the needs, and the best way to use these funds. M. Emile Picard, secretary of the Academy of Sciences, and several members of the committee in charge of the fund, stated that, according to the desire of contributors, the funds would not be used to construct buildings or to organize classes of instruction, but to provide the material equipment needed.

THE curators of the university chest of the University of Oxford have been authorized to accept grants from the Development Commission and the Ministry of Agriculture and Fisheries for the purpose of research in agricultural engineering. This is part of a national scheme for agricultural research. The British government has decided that the Central Institute shall be placed at Oxford. The institute

will be concerned with the whole question of treatment of the soil, and problems will be raised of importance not merely to agriculture, but to science in general. The government will supply both capital and current expenditure, while the university is asked to provide a site.

THE *Journal* of the American Medical Association states that the universities of Cambridge, Oxford, Edinburgh and Cardiff have recently received donations from the Rockefeller Foundation. The sum of £100,000 will be provided for building a pathological institute at the University of Cambridge and £33,000 will be contributed toward the endowment. A similar offer has been made to the University of Oxford for the department of chemistry. The foundation has given £50,000 to the University of Edinburgh, Scotland, for medical teaching and research facilities. With this fund a clinical laboratory will be established in connection with the Royal Infirmary. An additional sum of £1,750 will also be granted annually for not less than five years toward the salary of the professor of surgery, which chair is at present vacant, on condition that the appointment shall be filled by a whole-time professor. The foundation has also given the sum of £14,000 to the Welsh National School of Medicine, Cardiff, Wales, to assist in developing the medical department.

THE Laboratory of Applied Science in connection with the Nela Research Laboratories of the National Lamp Works of the General Electric Company at Cleveland has been renamed the Lighting Research Laboratory. M. Luckiesh, who has been the director of this laboratory since it was added to the works at Nela Park, remains in charge. Dr. P. W. Cobb has joined the research staff. New work is being initiated in the study of glare, eye fatigue, speed of vision and increased production as affected by illumination intensity and quality of light.

BETWEEN June 15 and September 1, while there is no routine teaching of under-graduate students at the Stanford School of Medicine, properly qualified graduates in medicine and medical students of this and of other schools are invited to avail themselves of the opportunities for clinical and laboratory work as special workers. The workers are expected to assist in the practical work of the various departments. Their work will be supervised but no set courses will be given. Opportunity to make special studies of clinical and laboratory problems will also be offered. There will be a registration fee, and in some departments an additional fee for special instruction. The minimum period of attendance will be for four weeks. Participants are urged to devote their full time to one subject. Applications, which should give an outline of the medical experience of the applicant, should be sent to Dr. William Ophüls, the Dean, Stanford University Medical School, San Francisco.

THE faculty of the college of medicine of the University of Iowa will, from June 9 to July 18, conduct a public health summer school in cooperation with the United States Public Health Service. There will be four such schools in the country. Among the lecturers will be Dr. William J. Mayo and Dr. John H. Stokes, of the Mayo clinic; Dr. Victor C. Vaughan, of Washington, D. C.; Dr. H. S. Cumming, Dr. C. W. Stiles and Dr. L. L. Lumsden, of the Public Health Service. Several thousand physicians and sanitarians have expressed a desire to attend these special schools, according to an announcement of the United States Public Health Service. The aim is "to provide intensive training for all persons engaged in public health work; to furnish instruction which will enable practicing physicians to deal effectively with the more important causes of mortality and disability, especially with cases referred by industrial clinics, school clinics, public health nurses and similar agencies; to bring together practicing physicians, health officers and other sanitarians and thus to establish a more cooperative relationship in the work of disease prevention." The laboratories, clinical material and other facilities of the university will be placed at the disposal of the public health students.

ELABORATE preparations have been made to take cinematograph pictures of the third expedition to climb Mount Everest. Captain J. B. L. Niel, who was responsible for the film of the second expedition shown last year, is again in charge of this side of the undertaking. He and his party are taking fourteen cameras of all kinds and sizes, and he hopes this year to be able to photograph every phase of the expedition and, if success crowns the efforts of its members, to take the first pictures of the summit itself. A number of pictures are to be taken by a new process of color cinematography, invented by Freise Green. This is said to be not only comparatively simple, but commercially feasible, as the cost is only slightly in excess of that of the normal process. Certain portions of the films are to be sent to England, as they are taken by arrangement with Pathé Frères, and it is anticipated it will be possible to show them in London a month after they have been taken. The complete film, however, will probably not appear till next October, when it will be given titles, a thread of dramatic story and shown for a season at a West End theater by a new film company called "Explorers' Films, Ltd." When the complete film is shown it will be accompanied by Tibetan music recorded during the journey by T. H. Somervell, who did similar work last time, and orchestrated and fitted to its new environment by Eugene Goossens.

WE learn from *The Geographical Journal* that Colonel P. Kozloff is about to start on a new exploring expedition to Mongolia and Tibet organized by the Russian Geographical Society, this being the sixth in which he will have taken part, and the third under his leadership. It is planned to last three years, and will consist of twenty-one persons. During the present year the expedition will proceed to Kiakhta, and then make its way through Mongolio *via* Urga and Khara Khoto to the Middle Nan Shan and Tsaidam. It will spend 1924 in Tibet, exploring the elevated region about the sources of the Yangste, Mekong, Salween and other rivers, and carrying out researches in geology, botany, zoology and ethnography. It is impossible to say at present what further work will be undertaken, *e.g.*, whether it will extend to southern and eastern Tibet, which, with their comparatively rich vegetation and animal life, offer an attractive field for study; nor can it be said whether it will return through China, Mongolia or Eastern Turkestan.

THE council of the Royal Institute of Public Health has accepted invitations from the mayor and the University of Bordeaux to hold its annual meeting there at Whitsuntide. The president will be Viscount Burnham, and the local honorary secretaries, Professor René Cruchet, professor of medicine in the University of Bordeaux, and M. G. Faure, treasurer of the Chamber of Commerce. The meetings will take place in the university. Special arrangements are being made for traveling and hotel accommodation.

DURING the first quarter of the current year, there were registered in the ninety departments of France: 196,105 births (living infants); 190,036 deaths (19,014 infants under 1 year); 70,656 marriages, and 5,666 divorces. The excess of births over deaths, during the first three months of the year, was thus 6,069. In the department of the Seine, there were reported, between January 1 and March 31: 19,444 births, 18,830 deaths (an excess of 614 births), 11,322 marriages and 1,432 divorces.

THE New York State Agricultural Experiment Station has leased from Vassar College a building which is to be used for special research in entomology and plant pathology in the Hudson River Valley.

UNIVERSITY AND EDUCATIONAL NOTES

THROUGH the death of the widow of the late William F. Milton, retired merchant, who was graduated from Harvard University in 1858, the university receives a bequest of over a million dollars. The will directs that the money be used for the erection of a new library, but should the university possess an adequate library—which is the case—the money is to be used for research.

THE creation of a chair of hygiene and physical culture at McKendree College, Lebanon, Illinios, is provided for, and a bequest of more than 10 acres of land near the college is made in the will of the late Dr. Benjamin M. Hypes, St. Louis, a founder of the Marion Sims Medical College. It will be known as the Benjamin Hypes Professorship, in memory of the testator's father.

A $12,000 foundation, to be known as the Maurice Stern Fund for Medical Literature, has been given to the Tulane University School of Medicine, New Orleans, by Mrs. Maurice Stern as a memorial to her husband. The income from this will be used to purchase medical periodicals for the school library, and for medical books selected by the faculty.

THE board of directors, New Jersey Zinc Co., Palmerton, Pa., has voted a fund of $15,000 to Lehigh University, Bethlehem, for the founding of the New Jersey Zinc Co. research fellowship in science and technology. The income from the amount will be paid to the holder of the fellowship, who must be a graduate student from the institution in some division of engineering or science.

DR. CHARLES KEYSER EDMUNDS, who recently resigned the presidency of the Canton Christian College of China, has been elected to the newly established office of provost of the Johns Hopkins University.

DISCUSSION AND CORRESPONDENCE

"SOOT" IN COAL

WHILE on a visit to the Bertha Mine in the Scott's Run District, West Virginia, the writer's attention was called by the mine boss, Charles Miller, to a soft, wet inclusion in the Pittsburgh coal. Samples were gathered later through the courtesy of Mr. Miller and his assistant, Mr. Brown, and a brief study was made of the occurrence.

This inclusion, called "soot" by the miners, varies in color from brown to dull black when wet. When dry, all specimens collected were brown. The wet masses are of soft putty-like consistency, modified in some specimens by a distinctly gritty feel. When worked in water, most of the mass breaks into minute, formless particles which are held for some time in suspension, and into heavier gritty particles or pieces which quickly go to the bottom. This gritty material was found by qualitative tests to be mostly sulfur and iron, which it will be assumed were combined, at least before alteration, as pyrite. Some unaltered coal was found included with the grit.

When dry, the soot looks very much like the "punk"

of decaying wood and some is light enough to float on water. A loss of 36 per cent. of the mine wet weight and considerable shrinkage in volume was found after drying a sample on the water bath. Especially when wet it readily stains the hands, this possibly giving rise to the name.

The soot is found in elongated, flattened to cylindrical masses, not limited to any portion but most frequently found in the upper part of the coal. The shape of the inclusions suggested vegetation that had resisted alteration, but the lack of contact markings or of definite structure discouraged such a conclusion.

While sometimes in contact with bright coal, the inclusions are usually surrounded with a bony or pyritiferous material. The study so far made suggests the contained pyrite (and surrounding pyrite when present) as responsible for the soot. As particles of unaltered coal occur mingled with pyritic matter in the soft organic mass, it seems probable that the original coal has been altered to this condition by the presence of the pyrite and circulating ground water, which have destroyed the structure and changed the physical characters of the coal. The change might be brought about in part by physical shattering of the coal as the included pyrite was altered, as well as by chemical action. In several ways the soot behaves like the adjacent unaltered coal, including its manner of coking under the blowpipe flame. Unlike the action on coal, the action of nitric acid on either the raw soot or on the washed gritty residue is strikingly vigorous. This is believed to be due to either the finely divided or disintegrated state of the pyrite.

Samples were shown to Mr. David Reger of the State Survey, who states that he has noted occurrences of similar nature in several coals found in West Virginia, but has made no special study of them. Dr. I. C. White, head of the survey, kindly offered the services of the survey chemist, Mr. B. B. Kaplan, in making an analysis. The report of this analysis, just received, tends to confirm the writer's conclusions. The following results were obtained for the "darker" specimen "which analyzes as though it were a crushed bituminous coal":

Moisture	17.15 per cent.
Volatile matter	39.74 per cent.
Fixed carbon	30.31 per cent.
Ash	12.80 per cent.

No quantitative analysis for sulfur or iron was made, but attention was called to the probably high content of each. "The brown variety behaves more like a crushed coal that has been exposed." This statement would suggest that the disintegrating chemical action had proceeded farther in the case of the lighter color.

The readiness with which most of the pyritic matter settled out of the mass when washed with water may imply that it is foreign and probably feasible to reduce in unaltered coal by modern crushing and washing methods when its content becomes too high.

The amount of "soot" in this mine is too small to have any economic significance, but the occurrence seems sufficiently interesting to warrant some discussion as to its presence in other localities.

Earl R. Scheffel

West Virginia University,
Morgantown, West Virginia

WEAK LEGS IN CHICKENS

During the past few years a number of investigators have attempted to use young chicks as experimental animals in the study of nutrition problems. Some have reported favorable results while others have been unable to grow normal chicks in confinement even when feeds were used that had proved to be adequate for rats and other experimental animals. The chicks usually developed a condition known as "weak legs" which is characterized primarily by improper bone development and the failure to develop secondary sexual characteristics.

Experiments which we are now conducting show this condition to be identical with rickets in mammals. The lesions are the same and the conditions under which it is produced are the same as those which cause rickets.

These experiments show that young chicks receiving a standard scratch feed and mash supplemented with sprouted oats and fresh buttermilk will develop rickets (weak legs) if they are kept in a room where the light is filtered through glass, while chickens receiving the same treatment but exposed to direct sunlight a few hours each day will develop normally. Ultraviolet light was found to have the same beneficial effect as sunlight. It was also found that cod liver oil, which has been shown to contain a substance which will prevent rickets in mammals, would prevent this condition in chickens.

A complete report of this experimental work will appear in *Poultry Science* in the near future.

J. S. Hughes

Kansas State Agricultural College

NITROGEN LOSSES FROM COMPOSTS

The loss of nitrogen from compost and manure heaps is the avenue for waste of the greater part of this element in feeds. Even under most careful handling this waste is not readily controlled, because while mechanical safeguards against leaching, etc., may be employed, there still remains the considerable loss through the atmosphere due to biological agencies.

The value of nitrogen fertilizers in fixing the or-

ganic matter of manure, and the desirability of incorporating highly nitrogenous materials in composts add to the importance of preventing any loss of the element.

In a series of compost mixtures prepared and stored in the greenhouse it was found that loss of nitrogen to the atmosphere was prevented when powdered sulfur was included in the mixture at the rate of two pounds sulfur per hundred pounds of the mixture (dry basis).

A compost of six parts Florida soft phosphate, three parts dry soil, two parts cottonseed meal and one part dried stable manure, when kept at optimum moisture content for seven months in glass jars lightly covered, had lost, principally through ammonification, 60 per cent. of the original total nitrogen present. Ammonia nitrogen varied irregularly from the original 0.075 per cent. to 0.149 per cent. at the end of seven months. A sample obtained after six months and analyzed without drying showed a loss of 32.8 per cent. of the original nitrogen. After carefully drying this sample at low temperature the nitrogen content was further reduced from 1.193 per cent. to 0.809 per cent. (dry basis). The ammonia nitrogen of the moist sample was 0.346 per cent. and in the sample after drying showed 0.134 per cent.; ammonification proceeded rapidly during the first stages of drying.

When sulfur was included in the compost at the rate of two pounds per hundred of mixture the original nitrogen content was 1.535 per cent., and after seven months it was found as 1.567 per cent. In this mixture the ammonia nitrogen had increased regularly from 0.065 per cent. in the initial sampling to 0.767 per cent. in the ninth and final sampling, indicating that the conserving action of the added material was due to sulfofication rather than to the retarding of ammonification.

The practical significance of course is in the possibility of checking the enormous losses of a valuable form of nitrogen by a simple expedient.

F. H. SMITH

GEORGIA EXPERIMENT STATION,
EXPERIMENT, GA.

SCIENTIFIC BOOKS

External Insect Anatomy. A Guide to the Study of Insect Anatomy and an Introduction to Systematic Entomology. By ALEX D. MACGILLIVRAY. Scarab Co., Urbana, Ill. 1923. X + 388 pp.

THIS text, which, in the words of the author, has been prepared to meet "the needs of students," deals wholly with descriptive, external anatomy of insects.

The introductory chapter opens with a brief historical account, followed by a synopsis of the Hexapod orders, a section on the technical nomenclature of orientation, and a section of miscellaneous definitions. Chapter two treats of the fixed parts of the head, twelve pages being devoted to a general discussion of the vertex, front, ocelli, clypeus, labrum, occiput and other parts of the head structure. Then come detailed descriptions of external features of the heads and tentoria of twelve representative species of the principal orders. The movable parts of the head are considered in the 82 pages of Chapter 3. This part is divided into eight sections dealing with the compound eyes, antennae, mandibles, maxillae, labium, the Hymenopterous maxillae and labia, the pharynx and Dipterous mouth parts. Under each section the general features of the appendages are first explained, after which detailed descriptions are given of these parts in a number of insects.

In Chapters 4 and 5, which deal with the external structure of thorax and abdomen, respectively, there follows, after a preliminary account, descriptions of the thoracic and abdominal sclerites and abdominal appendages of a few species belonging to the orders Orthoptera and Coleoptera, and in the case of the abdomen, of the Lepidoptera and Diptera also. The legs and the wings are minutely described in Chapters 6 and 7. The Comstock-Needham system of naming the wing veins is closely followed. Of the 142 text figures, all but eleven are of the wing venation. The concluding pages of the book are devoted to a list of the species described and to an index of 20 pages with accented and syllabicated technical terms.

Though intended by the author as a text-book for students' use, to the reviewer it seems that its greatest field of usefulness will be to systematists and teachers of insect morphology, for, as the author says, "a thorough knowledge of the external anatomy of insects is fundamental to their taxonomy." There is no gainsaying the statement that a uniform terminology covering all insect orders for the sclerites and appendages of the body is highly desirable. With increasing activity in systematic entomology and the discovery of new taxonomic characters the need for a more extensive, but at the same time uniform, terminology, is felt. In this book there is rendered accessible to the entomologist for the first time in many years an account in English on the comparative external anatomy of insects, with clear-cut definitions and many illustrative examples. The attempt to reconcile the systems of nomenclature of the morphologist and of the systematist is most praiseworthy.

Whether the book will be accepted as a text by many teachers of entomology remains to be seen. If adopted, the teacher must of necessity make a judicious selection of the material as there is much

more offered than can be given in the time usually allotted to such a course. The work as here outlined is unquestionably not intended for the casual student who first enters upon the study of entomology as a part of a liberal education. But, on the other hand, if an entomological student's interest can not survive the rigorous drill demanded of him by the course outlined in Dr. MacGillivray's text, then he probably has not the making of an entomologist in him.

In the opinion of the reviewer, there are more new terms proposed than appear absolutely essential, some of them replacing older ones, without any apparent justification. Thus, the term *alacardo* is applied to a part which already has two other names. And so with many others. It is true, as the author says, that names of parts of animals are not subject to rules of biological nomenclature; nevertheless, an arbitrary change of a well-established term is sure to cause confusion. Furthermore, the fact that hybrid combinations of Latin and Greek terms abound does not warrant the erection of others of a similar nature. The use of the plural form ocellae to designate simple or adaptive ocelli is particularly objectionable on both philological and practical grounds. It is rather doubtful also if the various mutations, ocellalae, ocellanae, ocellarae and ocellasae, to designate the several types of simple eyes, will find acceptance. It is not clear why mesowing and metawing are more appropriate than the words fore wing and hind wing. This list might be greatly extended. These faults, however, are trivial and need not interfere with the usefulness of the work.

The most serious defect is the lack of adequate illustrations. Suitable detailed diagrams of the parts of head, thorax and abdomen of a number of representative insects would greatly have enhanced the value of the book as a reference text. The fear that students would make an illegitimate use of such figures is groundless, since the illustrations might have been made representative of forms not in common use in the laboratories.

The work is a notable contribution to insect anatomy; and while in some cases there are homologies suggested upon which specialists do not agree, as, for example, that of the clypeus and front of the Cicada, nevertheless it is, on the whole, a safe guide for entomologists to follow and it should prove of greatest value to students, teachers and systematists alike.

O. A. JOHANNSEN

CORNELL UNIVERSITY

The Rhind Mathematical Papyrus. Introduction, Transcription, Translation and Commentary. By T. ERIC PEET, Brunner Professor of Egyptology in the University of Liverpool. The University Press of Liverpool, Limited. London, Hodder & Stoughton, Limited, 1923. Folio, 1 + 136 pp., with 24 plates. Price, 63 shillings.

No lover of the history of mathematics as an integral part of the general history of the slow intellectual development of mankind can fail to welcome with keen delight the new translation of the Rhind Mathematical Papyrus, with very full notes by Professor T. Eric Peet, of the University of Liverpool. This papyrus, by far the most important of the papyri of Egypt which treat of their mathematical processes, was discovered in a building near the Ramesseum about the year 1858, and coming into the possession of a Mr. Rhind, from whom its name is derived, is now in the British Museum.

A translation into German was made in 1877 by Professor August Eisenlohr, assisted by Dr. Cantor, which, for the state of knowledge of Egyptology of that date, must be considered as a remarkable production. This translation, however, is now entirely out of date and has many small errors. During the past fifty years our knowledge of the Egyptian language has very greatly increased. Hence, a new translation and commentary have long been a desideratum.

The early pages of the scholarly work before us contain a naccount of previous studies of the Rhine papyrus, a description of the papyrus, including a discussion of its date, and an account of its contents and of documents available for the study of Egyptian mathematics. The general character of Egyptian mathematics is considered in some detail on pages 10–24. A comparison of mathematics of the Egyptians and Babylonians is indicated on pages 27–31, and this is followed by a sketch of Greek influence on Egyptian mathematics. The English translation of the original hieratic text and commentary occupy pages 33–131. The plates at the end of the volume include a hieroglyphic translation of the hieratic made from the papyrus itself.

Professor Peet has brought to his work not only the mind of a trained Egyptologist, but also an interest in mathematics, and I, who have given some years of study to the papyrus, have nothing but praise for the way in which the work has been done. While I may not agree entirely with some of the details of Professor Peet's explanations of the various mathematical processes, the care with which the translation is made and the thoroughness and clearness of the notes is very great. The book should be placed in every mathematical library in the country, and should be studied by every one who wishes to understand the mathematical processes of the Egyptians approximately seventeen centuries before Christ.

It is interesting to note in this papyrus the beginning of several of our present mathematical processes. For example, division was really performed by mul-

tiplication, problems which with us would lead to equations were solved by a process of trial, a general rule was often derived from special numerical examples. In the same way to-day mathematicians by a kind of induction often find a rule from a special example, but this must afterwards be proved.

One receives the impression from Professor Peet's work that the mathematics of the Egyptians was developed largely in caring for the needs of their daily life. On the other hand, in a recent account of the Edwin Smith Medical Papyrus, J. H. Breasted, professor of Egyptology and Oriental history at the University of Chicago, has expressed the opinion that the surviving mathematical papyri clearly demonstrate the Egyptian's scientific interest in pure mathematics for its own sake. With this point of view I am in entire sympathy. To me the whole papyrus seems to be constructed on a scientific basis, and is not a mere collection of problems for practical use. Easier problems come before more difficult ones in the same way as in a modern arithmetic.

Arnold B. Chace
Brown University

LABORATORY APPARATUS AND METHODS

INDICATOR REACTION AS A SOURCE OF ERROR IN pH DETERMINATIONS

The colorimetric determinations of hydrogen-ion concentrations, expressed as pH, are now a part of routine procedure in various lines of work. In many cases no electrometric check is feasible and the prevention of errors incident to the preparation and use of standard buffer and indicator solutions is of paramount importance. The purpose of this paper is to point out one of these errors, that is, the change of reaction of indicator solutions stored in glass bottles. It has been found that such a change will in many cases seriously affect the results obtained and that the use of the same indicator solution in both the standard and the unknown solutions does not remove this error.

In the course of some determinations of the pH of soil extracts it was found that the readings were in several cases too high (*i.e.*, alkaline) and change in the reaction of the indicator solutions used, probably due to alkali dissolved from the storage bottles, was found to be the cause. Forty-three soils were tested with indicators both unadjusted and corrected as to reaction, and, of these, twenty-two showed a difference in readings of from .3 to .9 between the adjusted and the unadjusted indicator solutions. The usual experimental error in determinations of this kind is less than .2. Buffer solutions tested under similar conditions showed no differences of color. The need for such indicator adjustment has been noted by Karraker in his recent paper on soil reaction studies.[1]

It is in some cases necessary to adjust the reaction of the indicator solutions quite frequently, and it has been found that a convenient means for doing this, when electrometric apparatus is not available, is by the "spot" method. An ordinary porcelain plate used for color reactions is suitable for this purpose. Twenty milliliters of the indicator to be adjusted are taken from the stock bottle and a drop placed in one of the depressions on the plate. A drop of N/20 hydrochloric acid is then added to the 20 ml. and another drop placed on the plate. This procedure is repeated until the acid color is reached. A spot is now selected which corresponds as nearly as possible to the color midway of the workable range of the indicator. A buffer solution of the desired pH plus the indicator being tested may be used for comparison or the colors in the excellent chart in Clark's book on hydrogen ion concentrations[2] may be referred to. The use of this chart provides a simple and efficient method of comparison as the flat colors more nearly approach the "spot" colors for comparative purposes than do the tubes of standard buffer solutions. The proper "spot" may also be approximated by selecting the one in which the two component colors of the indicator appear most nearly equal. Having decided on the proper color a quantity of the stock indicator solution is adjusted to this point by the addition of a calculated amount of N/20 hydrochloric acid. It will be found, after repeating this procedure once or twice, that the "midway" color can be readily determined without a preliminary 20 ml. test.

For highly buffered solutions this adjustment of the reaction of the indicator is apparently unnecessary, but for unknown solutions or those of known low buffer content it is essential, for if this source of error is disregarded there can be no assurance as to the accuracy of the results obtained.

Franklin W. Marsh
U. S. Department of Agriculture

SPECIAL ARTICLES

OBSERVATIONS ON TAXONOMIC FACTORS USED IN THE GENUS CERCOSPORA

The fungi which are included in the genus Cercospora have been and still are classified on the basis of spore size, host reaction to parasite and known host range of the causal organism. This taxonomic

1 "A Note on Soil Reaction Studies," P. E. Karraker, *Soil Science*, Vol. 15, No. 6.

2 "The Determination of Hydrogen Ion Concentrations." (1922 Edition.) W. Mansfield Clark.

method presupposes (1) that environmental factors such as moisture and temperature exert little if any influence on the size of fruiting structures, (2) that the inherent differences in host plants do not affect the size of spores, and (3) that the reaction of the host is a response to a definite and specific stimulus of the organism.

For their bearing on this subject the following observations are submitted. They are the results of work done during 1921–1922, in Central Luzon, Philippine Islands.

CULTURAL STUDIES

The following organisms were isolated and studied in pure culture on various media: *Cercospora lussoniensis* Sacc. on *Phaseolus lunatus, C, manihotis* P. Henn. on *Manihot utilissima, C. melongenae* Welles on *Solanum melongena, C. duddiae* Welles on *Allium cepa*, and *C. averrhoi* Welles on *Averrhoa carambola.*

On nutrient agar, potato glucose agar, agar decoctions of the various host tissues and on cooked corn meal, the organisms appeared similar with the exception that when they were young the growth of each organism was slightly enhanced by the decoction made from its respective host plant tissue.

SEASONAL VARIATION IN SPORE SIZE

Conidiophores and conidia from lesions on the following hosts were measured during the dry and during the rainy season: *Dolichos lablab* (*Cercospora* sp.), *Ipomoea batatas* (*C. batatae*), *Phaseolus lunatus* (*C. lussoniensis*), *Psophocarpus tetragonolobus* (*Cercospora* sp.), *Sesamum orientale* (*C. sesami*), *Solanum melongena* (*C. melongenae*).

The measurements obtained disclosed the fact that the fruiting structures were anywhere from 50 to 150 per cent. longer when produced in the rainy season. The great variant during the rainy season appeared to be moisture, and it was conjectured that this might be one of the main factors responsible for the increase in length of spores. Therefore, further experiments were performed.

EFFECT OF MOISTURE ON SPORE SIZE

Leaf-spotting diseases of the Cercospora type, while very abundant in the rainy season, are noticeably scarce during the drier periods. The following organisms were found in sufficient abundance in the dry season to allow of experimentation: *C. averrhoi, C. batatae, C. nicotianae* and *C. personata.*

By tying wax-paper bags containing rather large pieces of water-saturated cotton over leaves bearing lesions, it was possible to increase the relative humidity of the atmosphere to which the leaf was exposed, appreciably, for three or four days. After the leaves were exposed to this treatment for the period of time just mentioned, it was found that conidial length was increased from 30 to 80 per cent. over the measurements made from spores from undisturbed field lesions collected at the same time. Conidiophores were absent on all hosts used, with the exception of *Arachis hypogoea*, when the material was collected under normal field conditions. However, upon the addition of moisture, conidiophores of lengths as great as 130 microns were commonly produced.

HOST INFLUENCE ON SPORE SIZE

Phaseolus lunatus, Dolichos lablab, Curcurbita maxima, Glycine max, Ipomoea batatas, Macaranga tanarius, Manihot utilissima, Phaseolus aureus, Psophocarpus tetragonolobus, Ricinus communis, Sesamum orientale, Vigna cajang and *Vigna sinensis* were inoculated with pure cultures of *Cercospora lussoniensis* isolated from *Phaseolus lunatus.*

The measurements obtained from fruiting structures produced by these inoculations varied from 71.9 to 126.5 microns for the minimum lengths of the conidia and 127.9 to 236.0 microns for the maximum lengths. In making the inoculations an attempt was made to obtain parallel conditions of moisture. Because this is very difficult without delicate moisture controlling apparatus, there were, no doubt, slight variations. It is hard to believe, however, that variations which were possible under these conditions could exert a striking influence on spore development. The inoculations were performed during the rainy season when atmospheric moisture is at a maximum and temperature fluctuations are at a minimum.

CROSS INOCULATIONS

When plants were inoculated with pure cultures of *C. lussoniensis, C. manihotis,* and *C. melongenae*, conidia were produced from each fungus which were so similar that separation by means of measurements or other physical appearances was impossible. This constancy was true of each specific host only. Variations on different hosts were more or less parallel for all of the fungi.

It was also found that parasitism of the organisms was not confined to any particular family or group of plants. This appears striking on consulting the list of plants given above, all of which were readily parasitized by *C. lussoniensis.*

CONCLUSIONS

From the work which has been completed it appears that morphological differences, unless exceedingly pronounced, are of little value as taxonomic criteria. The host reaction, also, seems to lose its usefulness in separating causal organisms, for the appearance of lesions may be the result of a host function which is caused or stimulated by various and sundry irritants. The type of the leaf rather than the type of the irri-

tation appears to be the factor determining host reaction.

The only valuable taxonomic criteria which have presented themselves for use in separating various species of Cercospora are physiological behavior on artificial media and extent of parasitism.

COLIN G. WELLES
UNIVERSITY OF WISCONSIN

THE AMERICAN MATHEMATICAL SOCIETY

THE twentieth western meeting of the American Mathematical Society was held at the University of Cincinnati on Friday and Saturday, December 28 and 29, in conjunction with the seventy-fifth meeting of the American Association for the Advancement of Science. The total attendance at these meetings was about 100, among whom were 78 members of the society.

On Friday afternoon, December 28, there was a joint session with Section A of the American Association for the Advancement of Science and the Mathematical Association of America, under the chairmanship of Professor Harris Hancock, Chairman of Section A. The program of this session consisted of the following papers:

American mathematics during three quarters of a century: G. A. MILLER, Retiring Chairman of Section A.

On the equation of the eighth degree: A. B. COBLE, Retiring Chairman of the Chicago Section of the Society.

Arithmetics and their algebras: L. E. DICKSON.

The sessions of Friday forenoon, Saturday forenoon and afternoon were presided over by Professor Oswald Veblen, president of the American Mathematical Society, relieved by Professors R. L. Moore, A. B. Coble and R. C. Archibald. The following papers were read at these meetings:

Theory of construction of group generators as substitutions: W. E. EDINGTON.

On the summability of the triple Fourier's series at points of discontinuity of the function involved: BESS M. EVERSULL.

On a general theorem regarding divergent series, and its application to the double Fourier's series: GAYLORD M. MERRIMAN.

On necessary and sufficient conditions for convergence factors in double series: CHARLES N. MOORE.

Note on the map coloring problem: C. N. REYNOLDS, JR.

Concerning the prime parts of a continuum which separates its plane: R. L. MOORE.

Integral solutions of the Diophantine equations $\xi_1^2 + \xi_2^2 + \cdots + \xi_n^2 = \eta_1^2 + \eta_2^2 + \cdots + \eta_n^2$ *in the quadratic realm of rationality*: WM. KRAUPNER.

On algebraic equations whose roots are trigonometric functions: HARRIS HANCOCK.

Properties of abstract sets implied by properties of the class of all continuous functions: E. W. CHITTENDEN.

The classification of linear families of conics in various domains: ALAN D. CAMPBELL.

The isoperimetric problem with variable end points: MARY E. SINCLAIR.

The hanging chain with end points variable on curves in a plane: MARY E. SINCLAIR.

Covariants of differential forms of arbitrary order and degree: C. C. MACDUFFEE.

Number of cycles of the same order in any substitution group: G. A. MILLER.

Note on linear differential equations with constant coefficients: I. A. BARNETT.

Deflection of a rectangular plate clamped at its edges: H. W. MARCH.

A generalization of the Dirichlet problem: NORBERT WIENER.

On Brouwer's contributions to the foundations of mathematics: ARNOLD DRESDEN.

On the application of the theory of ideals to Diophantine equations: G. E. WAHLIN.

J. H. Rahn's mathematical symbols: FLORIAN CAJORI.

A generalized problem in weighted approximation: DUNHAM JACKSON.

On the zeros of polynomials: E. B. VAN VLECK.

On the Weddle surface and analogous loci: ARNOLD EMCH.

Note on Dirichlet and factorial series: TOMLINSON FORT.

On the dispersion sets of a connected point set: R. L. WILDER.

The theory of closure of Tchebychef's polynomials for an infinite interval: J. A. SHOHAT.

On curves whose first polars contain a pencil of lines: CHAS. H. SISAM.

Integral equations as differential equations of infinite order: H. T. DAVIS.

On the theory of numbers and generalized quaternions: L. E. DICKSON.

Quadratic fields in which factorization is always unique: L. E. DICKSON.

Geometric interpretation of the expression of an algebraic form as a determinant: A. B. COBLE.

Sets of three consecutive integers which are quadratic or cubic residues of primes: H. S. VANDIVER.

On Kummer's Memoir of 1857 concerning Fermat's last theorem: H. S. VANDIVER.

Necessary and sufficient conditions for the existence of a class of Stieltjes integrals: H. L. SMITH.

On polyhedra in Euclidean n-space: S. LEFSCHETZ.

An extension of the theorem that no perfect set is countable: R. L. MOORE.

Note on the integral theorems of vector analysis: LOUIS BRAND.

The Kurschak field of complex numbers: I. M. SCHOTTENFELS.

The error in Hartog's proof of the Zermelo theorem: I. M. SCHOTTENFELS.

ARNOLD DRESDEN,
Assistant Secretary